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Evaluation of Some Plant Materials Used for Feed, Food, and Medical Purposes by the Species Composition of Toxigenic Mycobiota and Frequency of Occurrence

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Abstract The purpose of the present work was dedicated to the study of toxigenic fungi by species composition, by the dominant species of fungal biota and their frequency of occurrence which involved in the formation of mycobiota of materials of some plants used for feed, nutritional and medical uses in Azerbaijan. In research, from the analysis taken from plants become clear that in the formation of their mycobiota in generally involved 85 species of fungi and 76,5% of them have toxicity. It became clear that fungi such as *Aspergillus flavus Link, A.ochraeus K. Wilh., Cladosporium herbarium (Pers.) Link, Fusarium moniliforma J. Sheld., F.oxysporum Schltdl., Penicillium citrinum Thom* and *P.cyclopium Westling* are the dominant species of the mycobiota of all studied plant materials. The obtained results can be useful as base data in the preparation of the principles of mycology safety in the use of plant materials for food, nutrition, and medical purposes.

Keywords Plant, Different purpose, Mycobiota, Toxigenic species, Frequency of occurrence, Phytotoxic activity

1. Introduction

As known, living things for the continue their activities constantly adopts various substances from the environment, and throw out their secret products. The production of nutrients used by living things, primarily by humans, is generally carried out in an open environment and this covers all stages of production. Under these conditions, interact of invisible creatures, such as microorganisms with these materials are inevitably and naturally, microorganisms are considered natural contaminants of plant, animal origin, and raw materials [5,11] and these characteristics are also compatible with the metabolites they form at the end of their life activities [1]. Both the microorganisms themselves, which are the natural contaminants of plant materials used for medicinal purposes such as food and feed, and the metabolites they form are characterized by a wide spectrum of diversity [2,11]. Whether microorganisms, or their metabolites, are negatively characterized, or are less harmful to the health of other living beings, are not small [9,20].

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Among the mushrooms which are adversely affected by life, toxigenic is the center of special attention. Though the toxigenic species of fungi (mushrooms) are still known to humans long ago, learning of the toxins they synthesize ran into the 60s of the last century [4,18]. The reason for this is therefore that the fungi that have these properties are the main pathogenicity factor leading to efototypes, which is due to the toxins they synthesize. It should be noted that toxigenic microscopic fungi are broad and heterogeneous according to their mutual morphological manifestations, nutritional and reproductive capacities, localities, developmental histories, and pathological effects of living organisms [2].

The richness of the Azerbaijani nature has spurred the widespread spread of mushrooms here and, therefore, a considerable amount of time, translating them into predominantly exploratory studies [7]. Even though these researches are not enough to precisely characterize the microbiota specific to the nature of Azerbaijan, they can also be characterized as systematic mycological studies. This idea is not to say about toxigenic fungi, so that only the toxigenic fungi are found among the fungi that are spread in the studies carried out.

For this reason, the toxigenic type composition in the formation of microbiota of various plant materials used for various purposes by making Azerbaijan is presented as an aim to define the dominant biota of general fungi.

2. Materials and Methods

As a research object, it is used as a research object in the Azerbaijani conditions in terms of feed, food and medicinal were toxigenic fungi that formed in the microbiotics of the plants (Artemisia absinthium L., Crocus sativus L., Cucumis sativus L., Cucurbita pepo L., Foeniculum vulgare Mill., Helianthus annuus L., Hordeum vulgare L., Laurus nobilis L., Medicago sativa L., Mentha piperita L., Onobrychis viciifolia Scop., Phaséolus vulgáris L., Pisum sativum L., Solánum tuberósum L., Thymus collinus Bieb., Triticum L., Vicia sativa L., Zea mays L.) materials used for the purposes. For the isolation of fungi were used both plants (grown on nature) and their dried masses.

In all cases, rice agar (DA), potato agar (KA) were used from the standard nutrient media [6,15], malted water (ASS), Capek medium (ACM). It was also used during the hiding of workers' cultures from these nurturing environments.

During the identification of fungi taken to the pure culture from noted nutritional mediums were used determinants compiled based on cultural-morphological and physiological signs [12,18,20]. The system of fungi has been used and named in the official site of the BMA [8].

The frequency of occurrence of fungi is determined by P = (n / N) X 100 formulas. Here, the frequency of occurrence of fungi (or the rate of spread of the pathogeninergic disease with -%) in the P - samples, n - the number of fungi detected (number of plant individuals caught in the investigated territory, number), and the overall number of N - specimens Total number).

The phytotoxicity of the individual fungal species involved in the mycobiota of the materials investigated during the course of the study was tested during the germination of wheat, beans, chickpeas and barley seeds. For this, a certain number of (100-150) seeds of each plant were used. The fungi are filtered for 5 days in a dry Capek environment, and the resulting biomass is removed (KM). The seeds used are placed in the same KM-de flour for 24 hours. Control is being used on sterile Capek. The seeds are then placed on the moistened filter paper and placed for sprouting for 7 days at room temperature (20-22°C). The phytotoxic activity (% - le) of the fungi is determined according to the formula P = (n / N) X100, in which case P-phytotoxic activity represents the number of n-germinated seeds and N - represents the overall number of seeds taken.

To compare the suitability of the individual microshenes, the serenity type compatibility ratio (K) was used [14]:

$$K=2C/A+B$$

Here, the number of species A and B - each senescence is the number of the same species in the senescence where C is constant.

All experiments were carried out at least 4 times and the results were statistically analyzed according to known methods [7]. In all cases, the results that responded to the formula m / M = P≤0.05 (where P -Styudent criterion, M-middle indicator, m- medium square regression) were honestly calculated and included in the dissertation.

3. He Results and Their Expression

It is understood from the results that the plant materials which are kept for various purposes are also characterized as one in the fungus settlements and they differ from each other in the type contents of the fungi in the formation of the mycocomplexes (table 1). As seen, 78.8% of the fungi involved in the formation of the mycobiota of forage products contain toxigenic fungi. The same indicator in the mycobiota of plants used for the food and medical purposes contain 75,0% and 67,5%. This is due to the difference in the biochemical composition of these plants.

Table 1. Numerical characteristics of the toxigenic generalized mycobiotae of plant materials used for various purposes

Purpose of use of plant materials	Total number of fungus recorded	Number of toxigenic species recorded
For feed purposes (Helianthus annuus L., Hordeum vulgare L., Medicago sativa L., Onobrychis viciifolia Scop., Vicia sativa L., Zea mays L.)	48	37
For medical purposes (Artemisia absinthium L., Crocus sativus L., Foeniculum vulgare Mill., Laurus nobilis L., Mentha piperita L., Thymus collinus Bieb.)	52	41
For feed purposes (Helianthus annuus L., Hordeum vulgare L., Medicago sativa L., Onobrychis viciifolia Scop., Vicia sativa L., Zea mays L.)	40	27
Total	85	67

It should be noted that the toxigenic fungi generally appear in the form of microbiotics of the miscellaneous materials 65 used for the analysis (*Alternaria alternate, A. calendnlae, A. fici, A. viola, Aspergillus athecius, A.austus, A.flavus, A. fumigatus, A. glaucus, A. nidulans, A. niger, A. versicolor, Aureobasidium pullulans, Botrytis cinerea, Cephalosporium roseum, Cephalosporium roseogriseum, C. rosum, Chaetomium globosum, Cladosporium carpophilum, C. herbarum, Colletotrichum dematium, Fusarium avenaceum, F.gibbosum, F.moniliforme, F. oxysporum, F.sambucinum, F. solani, F.sporotrichloides, Monilia sitophila, Mucor hiemalis, M. plumbeus, Penicillium chrysogenum, P.citrinum, P.citreoviride, P.cyclopium, P.decumbens, Penicillium expansum, P. funiculosum, P. lanosum, P. martensii, P. natatum, P. oxalicum, P.purpurogenum, P. rubrum, P. stoloniferum, P. tardum, Phoma exigua, Ph.herbarum, Trichoderma citrulloviride, Trichothecium rubrum, Verticillium alboartrum and Verticillium sp.*) Species such as *P. menthol, P. nigrescens, P.porri, Rhizopus stolonifer, Sclerotinia sclerotiorum,*

Septoria iridis, Sordaria lappae, Thielaviopsis basicola, Tilletia caries, Trichoderma albaum, Trichoderma asperellum taking place.

The occurrence of these fungi in the territory of Azerbaijan has been also confirmed in other studies [17], but this is not possible to say about the fungi such as *Alternaria violae L.D. Galloway & Dorsett, Cephalosporium roseogriseum (S.B. Saksena) W. GAMS, Penicillium citreoviride Biourge* and *Sordaria lappae Potebnia.* Because registration of this fungi in Azerbaijan is the first time.

The determination of the compliance coefficient of the species involved in the formation of the microbiota of the analyzed materials was found to be closer to that of the microbiota of the materials used for feed and food - 0.82. It is also understood that the compromise coefficient (0,70) of the species involved in the formation of microbiotics of drug and food products is slightly different from the agreement between feed and drug (0.77), and the compromise coefficient of the latter is closer to the first.

During assessing the frequency of occurrence of individual fungi involved in the formation of the mycobiota of the studied plant materials become clear that following is characterized by higher indicators:

Aspergillus flavus - 45,5%
A. niger - 57,2%
A.ochraeus - 46,1%
Cladosporium herbarium - 50,1%
Fusarium moniliforma - 53,2%
F.oxysporum - 56,4%
Penicillium citrinum - 47,8%
P. cyclopium - 48,9%

Relatively high frequency of occurrence of shown species on all investigated materials allows them to noted as dominant species.

According to the analysis of the literature, it can be recorded precisely, all of these fungi can bring a myriad of mycotoxins with various toxic effects [19]. Such toxins include, but are not limited to, aflatoxin, oxratoxine, Patulin, zeralenone, dezoskirivalenol, fumonizine, boverine, moniliformin, NT2-toxin, nivalenol, toxins, and they have the properties of cancer genes, tetragogens, immunodeqradator, mutagenes [2].

On the other hand, it was understood during the studies that the phytotoxic activity of these fungi is also characterized by a high indicator and their ability to germinate plants (beans, chickpeas and wheat) decreases by 50% in every case (table 2).

Aspergillus candidus, Aspergillus fumigatus, A. nidulans, A. austus, A. versicolor, Botrytis cinerea, Chaetomium globosum, Fusarium avenaceum, F. gibbosum, and other fungi are among the remaining species of the 65 toxigenic fungi commonly found in plants and plant material. *F. solani, Penicillium chrysogenum, P.citreoviride, P.decumbens, P. expansum, P. funiculosum, P. lanosum, P. martensii, P. natatum, P.purpurogenum, P. rubrum, P.stoloniferum, Trichoderma álbum, Trichoderma asperellum, Trichothecium roseum, Verticillium alboartrum, V.dahilae,* which is found to be common to the frequency of occurrence, which constitutes 41.5% of the fungi involved in the formation of mycotacts of plant materials. The quantitative indicator of the frequency of sighting for this group of mushrooms varies from 11.2 to 38.7%.

Table 2. The phytotoxic activity of some toxigenic fungi

№	Types of Mushrooms	Phytotoxic Activity (according to the number of seeds germinated),%		
		Wheat	Beans	Pea
1	*Aspergillus flavus*	53,4	52,2	57,2
2	*A.niger*	51,5	57,4	54,3
3	*A.ochraeus*	49,3	52,8	50,2
4	*Cladosporium herbarium*	55,5	57,2	56,7
5	*Fusarium moniliforma*	36,3	42,3	39,6
6	*F.oxysporum*	38,7	40,6	43,5
7	*Penicillium citrinum*	43,2	40,1	42,1
8	*P.cyclopium*	42,1	41,1	39,2

During the characterization of the frequently encountered fungal phytotoxic activites, their quantitative indication varied from 40.1 to 86.5%.

The remaining 30 species are characterized by random and rare species, with 46.1% of the total microbiota and the frequency of these fungi varying between 1.2 and 8.9%. For fungi belonging to this group, the phytotoxic activity indicator is between 65.5-89.4%.

It should be noted that the studied plants are widely used for various purposes both in Azerbaijan and in many countries of the world. The fact that these plants are also one of the habitats for fungi, and among them participates those that synthesize metabolites that are hazardous to health makes inevitable problems always at the center of attention. The information presented above proves it once again.

4. Conclusions

Thus, it is understood from the records made that the material used for various purposes (feed, food and medical) by making Azerbaijan is also one of the settlement places of fungi *and Aspergillus flavus, A.ochraeus, Cladosporium herbarium, Fusarium moniliforma, F.oxysporum, Penicillium citrinum* and *P.cyclopium,* and the frequency of occurrence is between 45.5-57.2% and phytotoxic activity is between 36.3-57.2%. The high content of toxigenic fungi on plants used for food, feed and medical the purpose makes it necessary to develop and strictly adhere to mycology safety Principles for Using These Products. The obtained results useful as database information for the work to be done in this area.

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